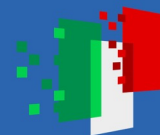




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Il Team per **ET** in
Italia
TETI

ET
ITALY 
Einstein Telescope



June 20, 2024

<http://www.einstein-telescope.it>



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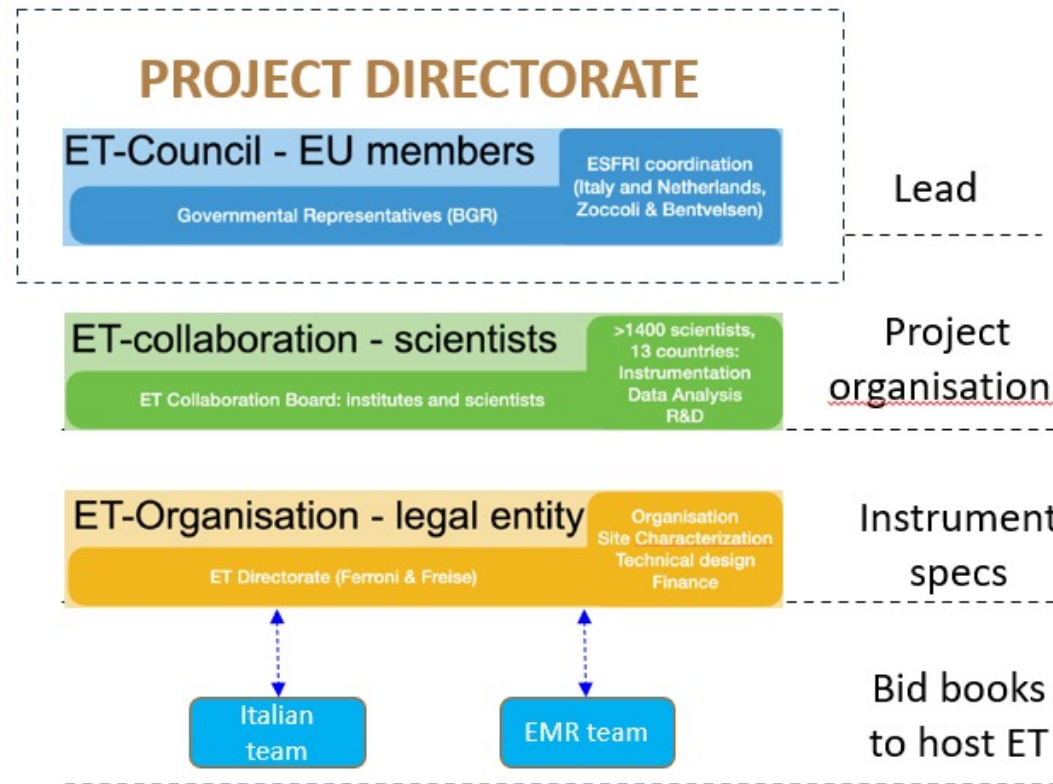
ET and the national teams

ETO, ETC and the local teams

are **not** (yet) hierarchically structured.

The **local teams** are funded
By their governments/Institutions

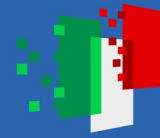
Goal of the local teams: to prepare bid books, to candidate their respective sites to host either **one Δ -shape (on either site) or 2 L-shaped ET detectors (on both sites)**



EMR EU Regio, at the border among NE, BE and D

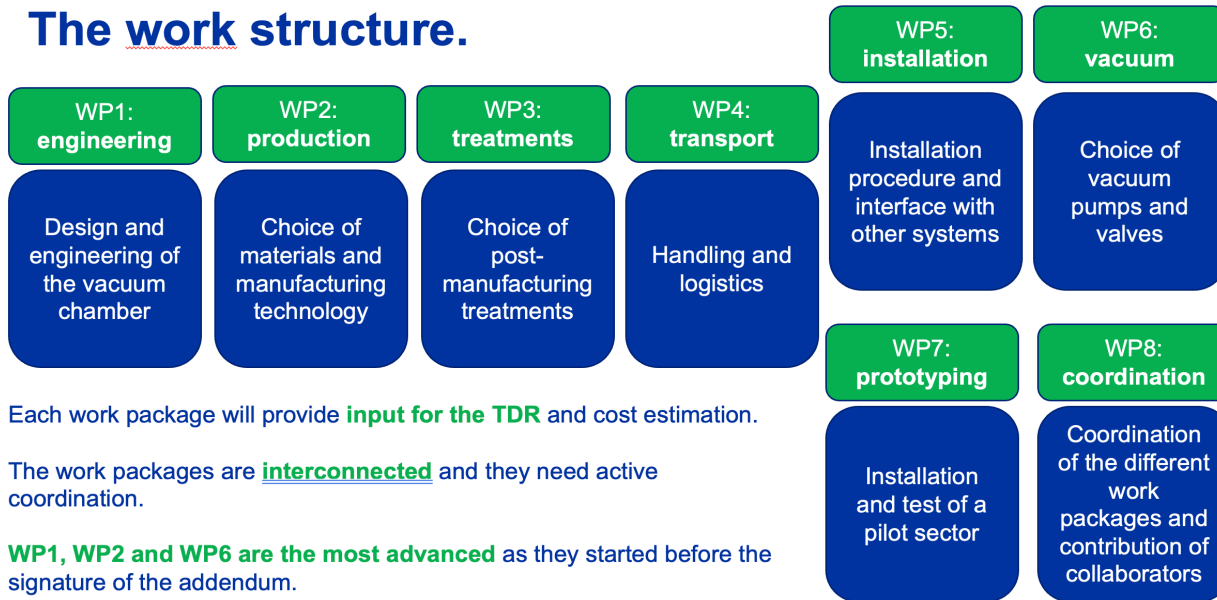


Sardinia (I)



Getting CERN on-board to help ETO: tube vacuum, civil engineering, technical infrastructures, cost&schedule....

The work structure.



Each work package will provide **input for the TDR** and cost estimation.

The work packages are **interconnected** and they need active coordination.

WP1, WP2 and WP6 are the most advanced as they started before the signature of the addendum.



Collaboration Agreement KN5637/TE/Einstein Telescope (Replacing KN4657/DG/Einstein Telescope)

Between

The European Organization for Nuclear Research
("CERN")

And

the Lead Institutes of the Einstein Telescope Collaboration:

The Italian National Institute for Nuclear Physics
("INFN")

And

The Dutch National Institute for Subatomic Physics
("Nikhef"),

And

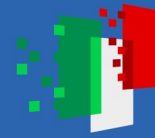
The Institut de Fisica d'Altes Energies
("IFAE"),

(hereinafter "Party" and collectively "Parties")

Concerning

Collaboration on the design of future gravitational wave
detection experiments

2023



TETI, EMR and ETO

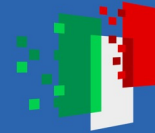
- ETO should have established the **site competition terms**, but has **not** (yet) done it
- Consistently with the ESFRI framework, the **local teams** started preliminary geological investigations and engineering, funded by their governments, to which (too, and primarily) they have to report
- Both started to organise themselves consistently, to prepare **bid books**



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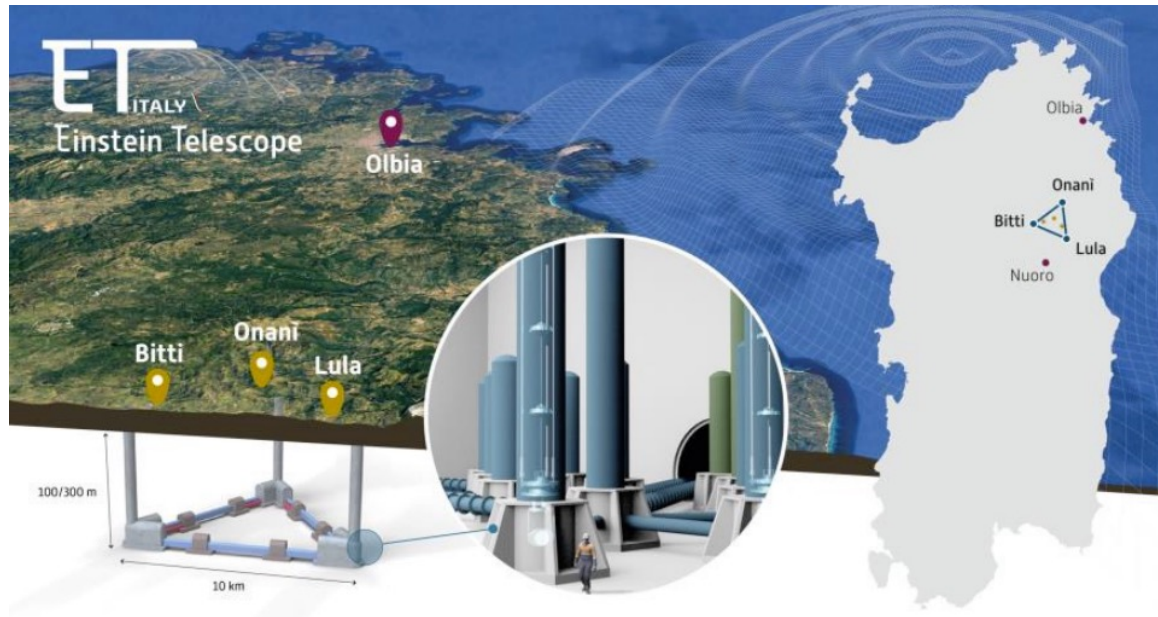
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- ✓ Low seismic noise
- ✓ Limited presence of groundwater
- ✓ Rock masses that are ideal for safely building the underground spaces for the ET laboratory
- ✓ Large rural areas (very low population density and, limited anthropogenic and industrial activity)

All this makes the area around Sos Enattos, between the municipalities of Bitti, Lula and Onani, the 'silent' environment that the ET needs to operate



The scope of TETI - TETI bid book structure

- Introduction, scope
- Local assets, local impact
- Governance
- Safety, environment (*)
- Detector description
- Local infrastructure (*) focus
- Legal aspects, costing (*), PM ...

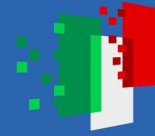
(*) with companies



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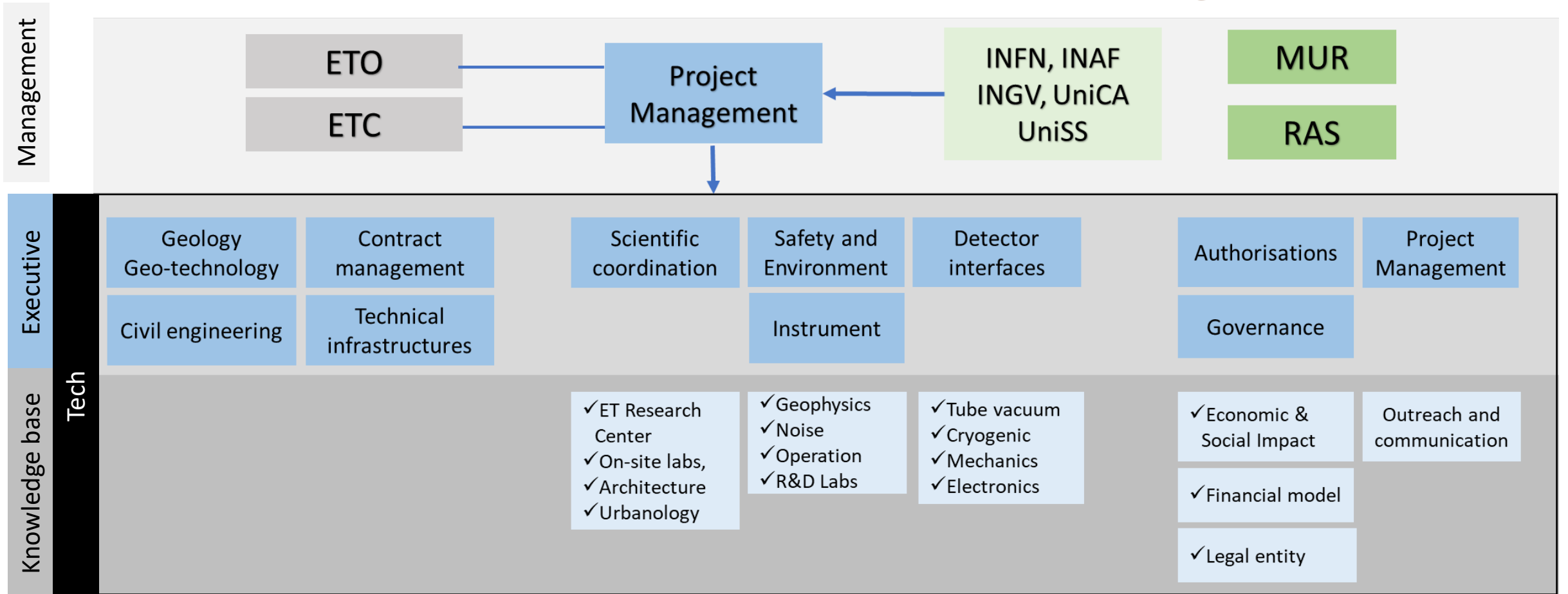


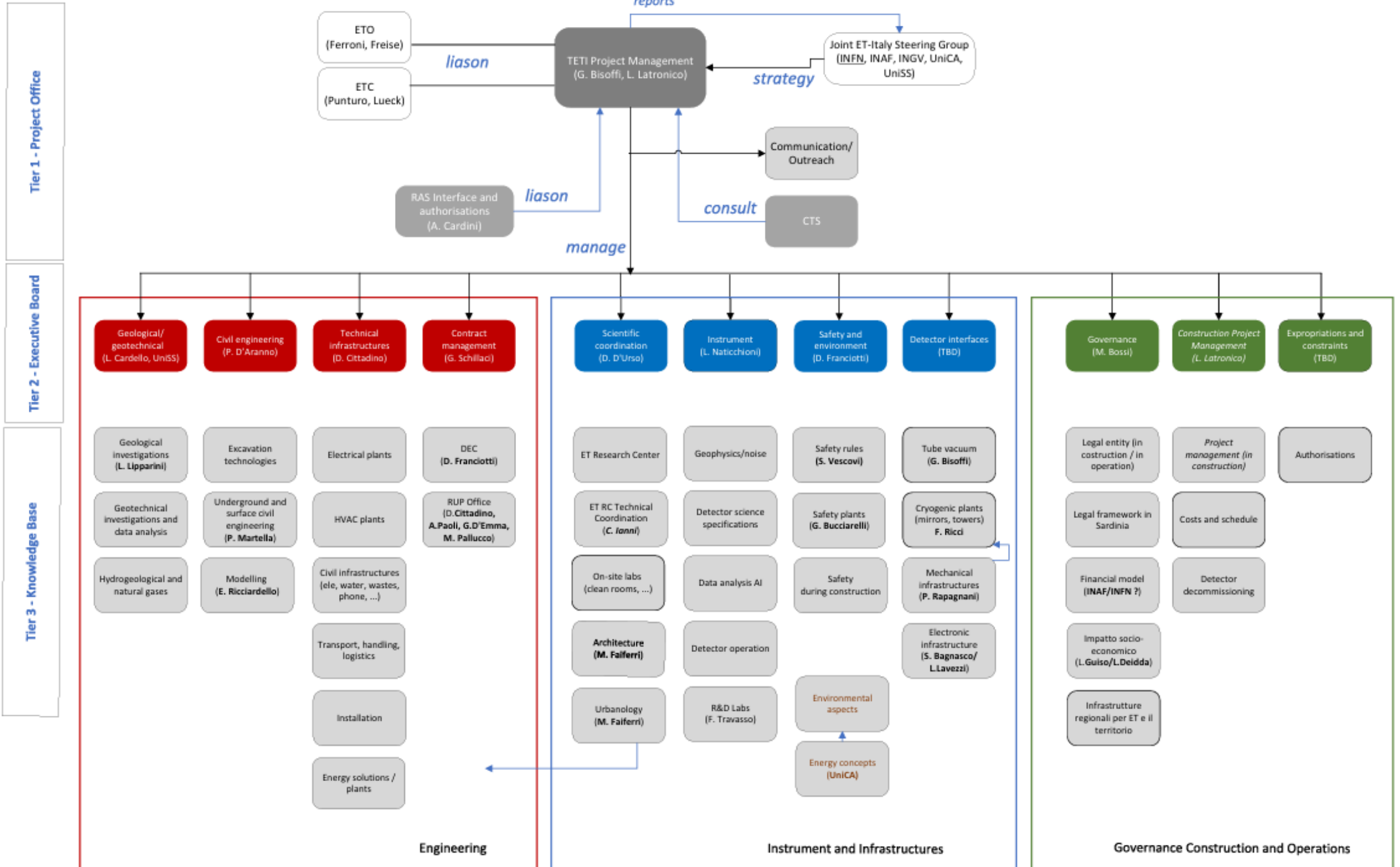
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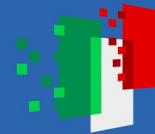


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TETI – Team for ET in Italy







Draft TETI Mandate (Team per ET in Italia; Team for ET in Italy)

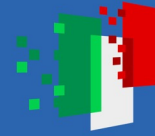
- ✓ Operational structure with the scope of **supporting Italy's candidacy** to host the Einstein Telescope detector in Sardinia
- ✓ **Ensuring the success of all the activities** necessary to support the Italian application, including the one provided for in the contract stipulated by the INFN with private entrepreneurs, giving a **technical, managerial and financial reference** to the project
- ✓ TETI **reports to** a supervisory structure the Institutes and Universities involved in ET-Italia (provisionally represented by INFN)
- ✓ TETI will **maintain** close and fruitful **contact with** the coordinators of ETO (Einstein Telescope Organization) and ETC (Einstein Telescope Collaboration).



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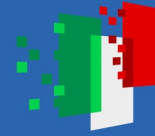
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TETI structure – work-in-progress

- TETI must incorporate **INAF** and **INGV** officially (high-level contacts in progress)
- The **steering group**, to which TETI should report, must be established
- **PMP** and individual mandates were drafted and should be then issued
- TETI presented to **INFN executive board** on June 10, to **Directors' Board** on June 27 – official appointment will follow



PMP



DocID	Rev.	Validità
TETI-PM-001	3.0	DRAFT

15April 2024

TETI Project Management Plan

Author	Verified by	Approved by
L. Latronico	G. Bisoffi	M. Pallavicini

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- Public

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The activity is structured in work-packages

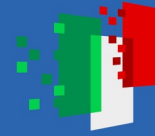
Work Package	Description
WP1 - TETI Management	Plan, organize and manage TETI activities. Manage stakeholders' requirements.
WP2 - Contract management	Manage INFN contract with RTI-RS for the feasibility studies in Sardinia
WP3 - Contract follow up	Review technical choices proposed by RTI-RS Validate contract deliverables.
WP4 - SUNLab	Plan and build the Sos Enattos UNderground Laboratory, for INFN, INGV, INAF, UniCa, UniSS
WP5 - DNSH & Sustainability	Ensure environmental sustainability and apply the DNSH principle throughout the project activities
WP6 - Sardinia Infrastructures	Local area infrastructures adequate to host ET during construction and exploitation phases
WP7 - Bid Book	Compile the candidature proposal (Bid Book)



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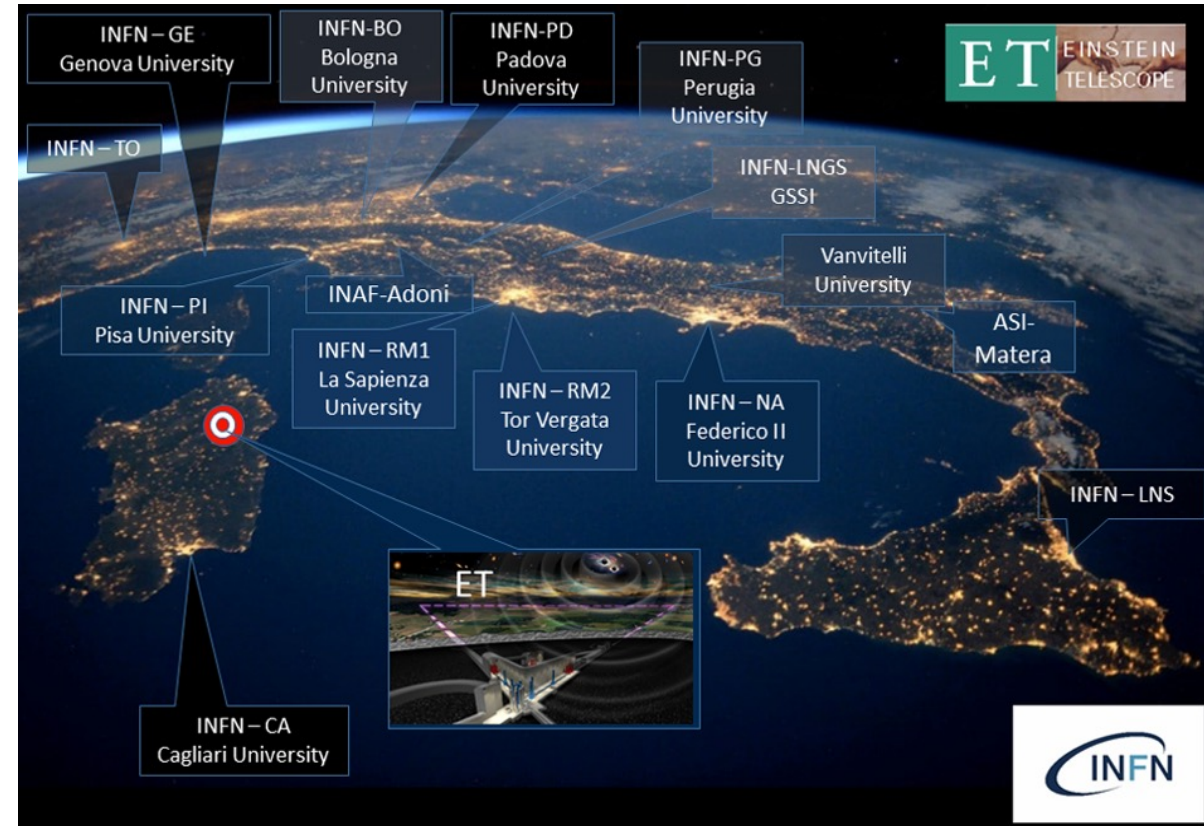
TETI's wallet

ETIC (PNRR Project, 50 M€) is a project funded by the Italian Ministry for University and Research

✓ Led by INFN and involves INAF, ASI and other 11 Universities, it aims to:

- Realize a **network or research infrastructures**, devoted to developing the ET enabling technologies and hosted in the laboratories of the ETIC partners

- Realise a **feasibility study of ET in Sardinia**, key element of the Italian bidbook, including, geotechnical and engineering studies

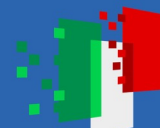




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The preliminary design

Goal of the contract:
technical/economic feasibility
study of each of the two
configurations T10km and L15km,
at a minimum 120 m depth.

For each configuration:
final report describing main
design and engineering solutions,
costs, environmental impact.

TAKING INTO ACCOUNT:

- Respect of the territory, **environment**, DNSH principle
- **Safety** of workers, during construction and operation
- **Scientific lab** efficiency
- **50 years** lifecycle
- **Minimum noise** in caverns

STUDYING:

- Underground siting of infrastructures, underground survey
- Underground infrastructures
- Surface infrastructures



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Temporary Association of Companies – led by Rocksoil SpA

Rocksoil S.p.A. main contractor- Milano [[geotechnical, hydrological](#)];

Leonardo Consorzio Europeo per l'ingegneria e l'architettura - Cagliari [[safety, external building architecture](#)]

Ferro Ingegneria S.r.l. - Torino [[technical plants](#)];

Criteria S.r.l. - Cagliari [[environment](#)];

INAR S.r.l. - Milano [[civil](#)];

GDP-Geomin S.r.l. - Torino [[geological](#)];

Geotec S.p.A. - Campobasso [[geotechnical and surveys](#)]

Contract awarded on Dec 18, 2023

Start of activities: [Feb 19, 2024](#)

Conclusion within: [June 30, 2025](#) (strictly limited by the European rules of the Recovery and Resilience Funds - RRF)





Contract execution and follow-up

RUP1 - Schillaci - Coordination, Technical plants 1, Energy
RUP2 - Franciotti - Contract technical execution, Safety, Civil Engineering
RUP3 - Cittadino - Technical plants 2
RUP4 - Paoli - Civil engineering 2, Virgo detector infrastructures
RUP5 - D'Emma - Detector installations
RUP6 - Pallucco (lawyer) - Tender administrative aspects

Contract execution (WP2)

D1-PLAN GEO ANALYSES-Geology, Hydro-geology, geol. risks, investigations
D2-UNDERGROUND CIVIL CONCEPT-Underground civil eng., materials, BIM, sizing, costs
D3-SURFACE CIVIL ENG-Civil, rules, urbanology, architecture, sizing, costs
D4-TECHNICAL PLANTS rules, design, costs
D5-CIVIL UNDERGROUND DNSH-IMPACT, investigation result, authorisation, constraints
D6-GEO ANALYSES-Geotechnical topographic investigations, geol. hydrogeol. models
D7-CIVIL UNDERGROUND FEASIBILITY-Underground civil engineering, techn. plants, environment
D8-AUTHORISATIONS- procedures, link to RAS and offices
D9 - VALIDATION

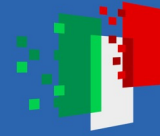
Follow-up of technical deliverables (WP3)



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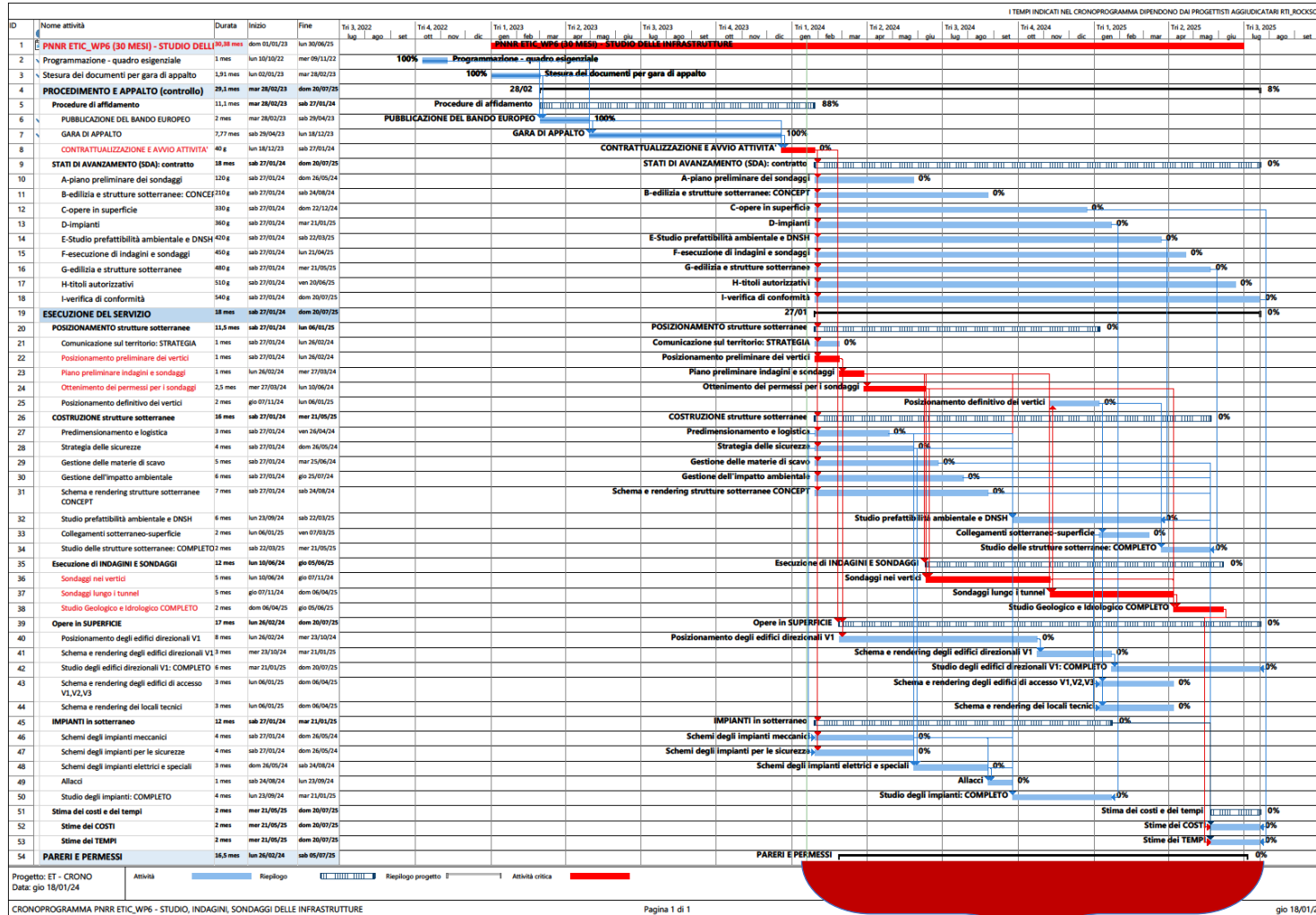


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Time schedule



Start: February 19, 2024

End: June 30, 2025

(constrained by the European rules of the Recovery and Resilience Funds - RRF)



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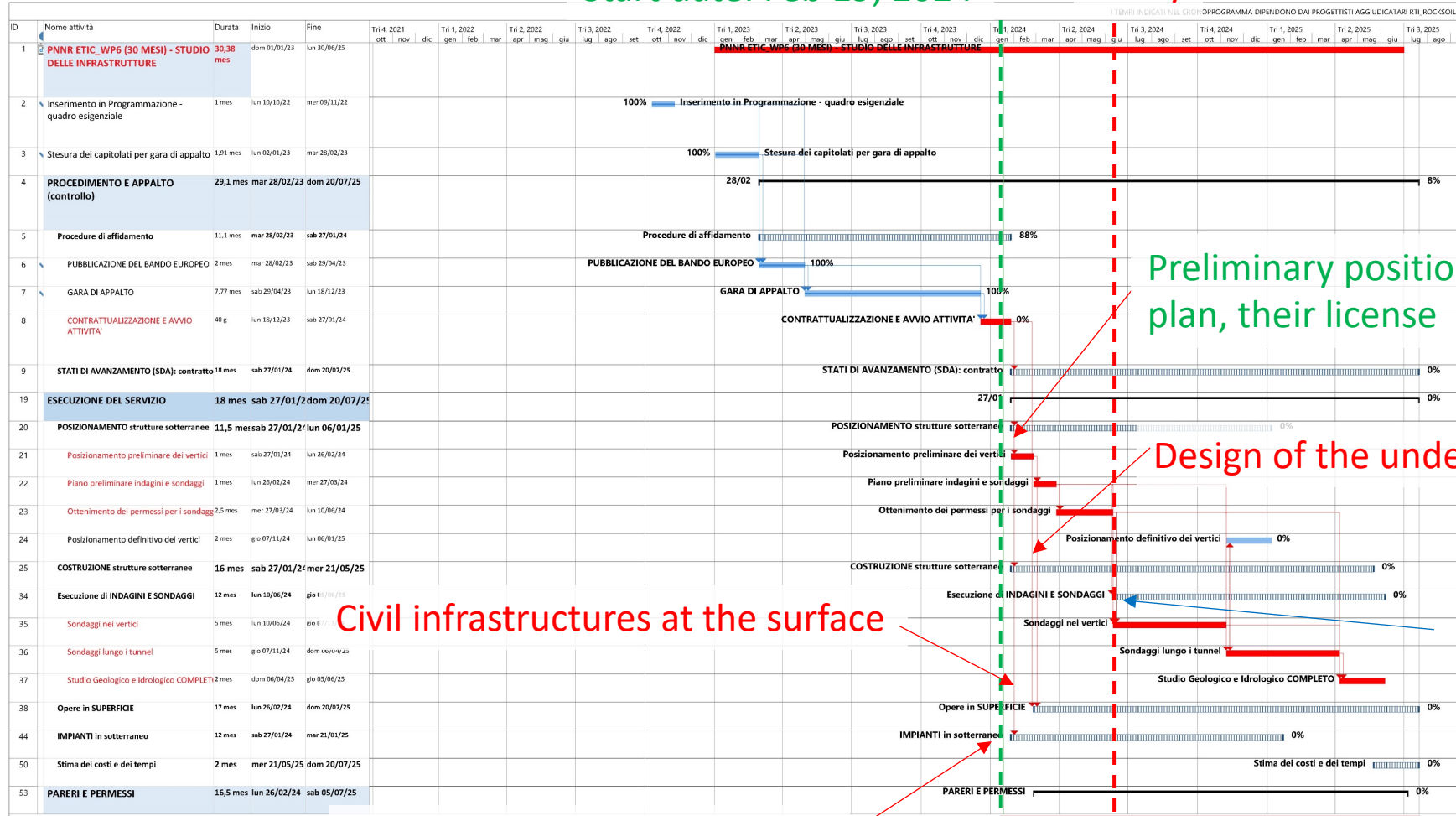
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Laboratori Nazionali di Frascati

Start date: Feb 19, 2024

Today

End date: June 30, 2025

Time schedule: critical path



Preliminary positioning of the vertexes, survey plan, their license

Design of the underground infrastructures

Civil infrastructures at the surface

Execution of the surveys, following approval of their plan (Deliverable achieved on June 18, on schedule!)

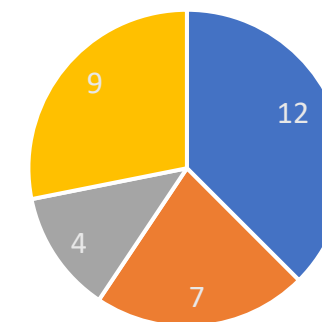
Underground technical plants



TETI meetings overview

- TETI-Internal meetings (getting **more focused** on tasks and groups) and with ETO:
 - Tech, Exec, RUP (Contract, admin-techn), WPs
 - ETO, ETO-ED
- Challenges
 - Compete with ETO, ETC and ETIC **calendars**
 - Plan efficiently and completely

TETI Meetings (Feb-May 2024)



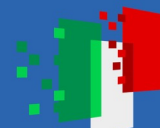
■ Tech ■ Exec ■ ETO ■ WPs

*3 per week on average
WP meetings must ramp up
WP-PM meetings to start*



TETI Meetings with ETO, ETO-ED

- TETI (and EMR-Eu Regio) started meetings with ETO and ETO-ED
- **ETO** and **ETO-ED** aim at ruling the process but:
 - ✓ Formalisation of **roles, tasks, content** of the bid books, ... are still lacking
 - ✓ The two teams are funded by (and report primarily to) their respective **governments**
 - ✓ The **Italian team has strict rules and boundaries** for completing the contract with the consortium of companies (← Italian government ← EU commission)
- → TETI decided to submit technical questions (and proposed answers) to ETO-ED as long as the technical activity progresses – not sure whether ETO-ED has a proper process in place to respond



First round of questions submitted by TETI to ETO-ED (on April 24)

1. Tunnel diameter (assumed: fixed)
2. Tunnel dewatering
3. Positioning of the L-shaped detector configuration (assumptions)
4. Available transverse space in the tunnel (from vacuum pipe infrastructure)
5. Materials, located underground
6. Electrical power table
7. Location of cryogenic refrigerator compressors

- ✓ Sharing of questions/answers among TETI, EMR and ETO is needed
 - ✓ These points **impact on the design** of underground infrastructures and technical plants
 - ✓ **Consistent** input from ETO-ED to the 2 teams is mandatory (boundary conditions)
-
- ✓ **Possible answers are proposed** (to ease ETO, ETC, ... analysis process)
 - ✓ **References** for answers: added
 - ✓ **Answers needed asap** (a couple of weeks, as for possible further question bunches)
 - ✓ In absence of prompt answer: TETI will have to proceed according to the proposed answers

CERN-ETO-TETI-EMR meeting, 29-30 April 2024



A notable ETO-TETI issue: the evolving layout

- TETI started working on the previous optical+detector Δ -layout. We are in full swing with the infrastructure details, BUT...:
- A new **optical** layout for the Δ -detector was released on May 31. A global layout (optical-detector-infrastructure) will progressively follow, in the 2nd half-2024
 - *from what we have seen, tunnel overall length: +21 km (=+70%)*
- **Optical** layout of the L-detector: release expected in fall 2024
- TETI is **considering whether** the **new** but «limited» **optical-only** layouts can be considered for the bid book:
 - **Reference documents** to be received
 - **Italian follow-up team** being identified (to bridge the gap of the still-missing detector layouts)



ET-in-Italy Review Panel

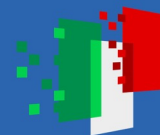
- INFN organized a global **review panel** to assess **all** activities aiming at hosting the ET-detector in Sardinia
- Plenary F2F meeting in September
 - Rome, two days in week 9-13 or 16-20 (precise dates definition is imminent)
 - Proposed agenda and participants
 - **DAY1** – ET and TETI reports (committee + INFN executive board + TETI-all)
 - Status of ET and collaboration with ETO and ETC
 - Site characterization
 - TETI overall report
 - TETI-WP specific reports, including Bid Book preparation
 - **DAY2** – Contractor report (DAY1+contractor)
 - Underground and surface engineering, environment, safety – **Reports by the companies**
 - **DAY 3 (HALF)**: recap, committee meeting, closeout?



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- ✓ The new layouts of the D and L detector are taking shape, carrying along the technological details
- ✓ Infrastructure configuration will be prepared for the NL and I competing sites
- ✓ The layout will be decided
- ✓ The site will be decided
- ✓ Stay on board: the future is NOW and ...
- ✓ ... it is in Sardinia !

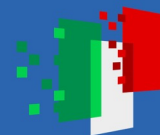
We have very exciting months in front of us!



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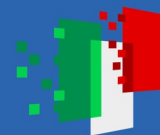
Spare slides



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Contract title

PRELIMINARY STUDY FOR THE DEVELOPMENT OF THE TECHNICAL AND ECONOMIC FEASIBILITY PROJECT OF THE EINSTEIN TELESCOPE GRAVITATIONAL WAVE OBSERVATORY IN THE SARDINIA REGION, IN DIFFERENT CONFIGURATIONS, INCLUDING THE EXECUTION OF INVESTIGATIONS AND SURVEYS AND THE PRELIMINARY ASSESSMENT OF ENVIRONMENTAL IMPACT FOR INFRASTRUCTURAL, UNDERGROUND AND SURFACE, BUILDING AND PLANT ENGINEERING WORKS



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General specifications of the main contract

- engineering solutions
- positioning
- environmental impact,
- costs
- construction time
- territory issues for underground works,
- territory issues for surface works,
- safety strategy,
- different excavation techniques,
- construction risks and their mitigation.



WP4: SUNLab

- ✓ GOAL: Realization of the Sos Enattos UNderground Laboratory (upgrade of the SarGrav Lab) to host **low seismic noise experiments**, low frequency **sensor development**, test of ET low frequency technology solutions, **low noise Earth Observatory**
- ✓ Funds: 20 M€ (10M€-Sardinia Region (RAS), 10M€-scientific institutions)
- ✓ Involved institutions: INFN, INGV, INAF, UniSS, UniCA, RAS.





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The socioeconomic study within WP6

Mandate

Provide a full study on the socio-economic impact of ET including: [employment](#), [technological spillover](#), map of the concerned [market sectors](#), and economic impact both during the construction and operation phases.

The study aims at identifying all impacts at large: e.g. scientific publications.

Committed by the Italian government under INFN supervision

Timeschedule

- Consolidated draft: May 2024
- [Final report](#): [October 2024](#)

Experts

- Luigi Guiso, Household Finance, Einaudi Institute for Economics and Finance (EIEF)
- Luca Deidda, Macroeconomics: Finance and Growth (Uni. of Sassari)
- Giovanni Carosio, Environmental Sociology (Uni. Of Trieste)
- Francesco de Carolis, micro economics (Uni. L. Bocconi)
- Alessandra Fagian, Applied Economics (GSSI)